Polynomials

5.1

**Constant**: a number
Examples: -2, 3, 3/5, 0

**Monomial**: a constant, variable, or product of these
Examples: 6, x, 3xy², −3abc²

**Degree of Monomial**: sum of degrees of the variables in the monomial
Examples: -8x²y⁴ \( D = 6 \)
9a²b⁴c⁸ \( D = 14 \)

**Polynomial**: monomial or sum of monomials
Examples: 6, x, 3xy², 2a² + 2b + 3c

**Degree of Polynomial**: the greatest of the degrees of its terms after the polynomial has been simplified.
Examples: 2x²y³ + 5x³y − 4x³y³ \( D = 6 \)
9xy³ − xy² + 2x⁴y⁴ − 3x²y⁵ \( D = 8 \)
You can classify a polynomial by degree or by the number of terms.

<table>
<thead>
<tr>
<th>Degree</th>
<th>Name Using Degree</th>
<th>Polynomial Example</th>
<th>Number of Terms</th>
<th>Name Using Number of Terms</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>constant</td>
<td>5</td>
<td>1</td>
<td>monomial</td>
</tr>
<tr>
<td>1</td>
<td>linear</td>
<td>x + 4</td>
<td>2</td>
<td>binomial</td>
</tr>
<tr>
<td>2</td>
<td>quadratic</td>
<td>4x²</td>
<td>1</td>
<td>monomial</td>
</tr>
<tr>
<td>3</td>
<td>cubic</td>
<td>4x³ - 2x² + x</td>
<td>3</td>
<td>trinomial</td>
</tr>
<tr>
<td>4</td>
<td>quartic</td>
<td>2x⁴ + 5x²</td>
<td>2</td>
<td>binomial</td>
</tr>
<tr>
<td>5</td>
<td>quintic</td>
<td>-x⁵ + 4x⁴ + 2x + 1</td>
<td>4</td>
<td>polynomial of 4 terms</td>
</tr>
</tbody>
</table>

Arrange terms in decreasing degree of x.
Classify each polynomial by degree and by term:

1. $3x^3 - x + 5x^4$
   $5x^4 + 3x^3 - 3$
   Terms: 3  Trinomial
   Degree: 4  Quartic
   It’s a Quartic Trinomial

2. $4x^3y^3 - xy^2 + 2x^4y - 3x^2y^5$
   $2x^2y + 4x^3y^3 - 3x^2y^5 - xy^2$
   Terms: 4  Polynomial of 4 terms
   Degree: 7  Polynomial of Degree 7
Homework 5.1 part A
p. 277 #1-3, 7-12, &15-18 all
p. 285 #8-18 even
Bring Graphing Calculator

Start Part 2
Activity 5.1

Needed dry erase marker & graphing calculator

In Groups of 3 complete the tables
Describe the behavior
(UP, DOWN, UP) etc.

The Degree of a polynomial function affects the shape of its graph and determines the maximum number of Turning Points or places where graph changes direction.

End Behavior: Up and Down
Turning Points: (−0.82, 1.00) and (0.82, 1.00)
The function is decreasing when $x < -0.82$
and is increasing when $x > 0.82$. The function is increasing when $-0.82 < x < 0.82$. 

End Behavior: Down and Down
Turning Point: (1, 1)
The function is increasing when $x < 1$
and is decreasing when $x > 1$. 

You can determine the end behavior of a polynomial function of degree $n$ from the leading term $ax^n$.

**End Behavior of a Polynomial Function With Leading Term $ax^n$**

<table>
<thead>
<tr>
<th>$a$ Positive</th>
<th>$n$ Even ($n \neq 0$)</th>
<th>$a$ Negative</th>
<th>$n$ Odd</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up and Up</td>
<td>Down and Up</td>
<td>Down and Down</td>
<td>Up and Down</td>
</tr>
</tbody>
</table>

$y = -x^2 + 2x$

$y = -x^3 + 2x$

Describe the End Behavior of the Polynomial Function

$y = -7x^3 + 8x^2 + x$
Degree = 3 $n$ is odd
$ax^n$ is $-7x^3$ $a$ is negative
The end behavior is Up and Down

$y = 1 - 4x - 6x^3 + 15x^6$
Degree = 6 $n$ is even
$ax^n$ is $15x^6$ $a$ is positive
The end behavior is Up and Up

Graphing Cubic Functions

$y = -x^3 + 2x^2 - x - 2$

<table>
<thead>
<tr>
<th>$x$</th>
<th>$y$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>-2</td>
</tr>
<tr>
<td>1</td>
<td>-2</td>
</tr>
<tr>
<td>-1</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>-4</td>
</tr>
<tr>
<td>5</td>
<td>-2.125</td>
</tr>
</tbody>
</table>

End Behavior: Up and Down
Two Turning Points
Using what you have just learned, check Activity 5.1

Activity
Max, Min, Zero’s using a graphing calculator
Handout

Homework 5.1 part B
p. 285 #21-37 odd,
50, 58, 59, 61 & 69-71 all